US007352930B2

(12) **United States Patent**
Lowles

(10) **Patent No.: US 7,352,930 B2**
(45) **Date of Patent: Apr. 1, 2008**

(54) **SHARED LIGHT PIPE FOR A MESSAGE INDICATOR AND LIGHT SENSOR**

(75) Inventor: **Robert J. Lowles**, Waterloo (CA)

(73) Assignee: **Research In Motion Limited**, Waterloo, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 281 days.

(21) Appl. No.: **11/187,867**

(22) Filed: **Jul. 25, 2005**

(65) **Prior Publication Data**

US 2007/0019433 A1 Jan. 25, 2007

(51) **Int. Cl.**
G02B 6/42 (2006.01)
G01J 5/08 (2006.01)

(52) **U.S. Cl.** **385/31**; 385/39; 455/566; 250/227.11

(58) **Field of Classification Search** 385/15, 385/31, 39, 88, 92; 362/555; 455/566; 250/227.11
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,964,824	A	6/1976	Dixon et al.	
4,576,436	A	3/1986	Daniel et al.	
5,963,687	A	10/1999	Schneider et al.	
6,687,515	B1 *	2/2004	Kosaka	455/566
2004/0013372	A1 *	1/2004	Gancarcik et al.	385/88
2004/0208632	A1	10/2004	Dietz et al.	

FOREIGN PATENT DOCUMENTS

DE	44 11 860	A1	10/1995
EP	1 303 113	A2	4/2003
EP	1336883	A1	8/2003
EP	1253447	A2	10/2004
EP	1 696 259	A1	8/2007
JP	60059548	A	4/1985
JP	05218581	A	8/1993
JP	07203124	A	8/1995
JP	2000-292631	A	10/2000
JP	2001215350	A	8/2001
WO	WO 01/05126	A1	1/2001

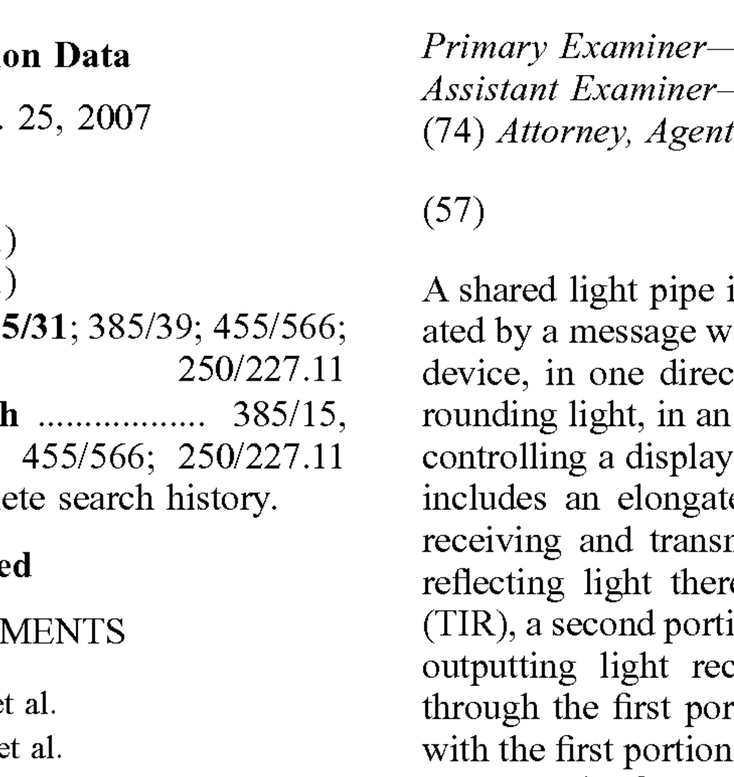
* cited by examiner

Primary Examiner—Frank G. Font
Assistant Examiner—Michael P. Mooney
(74) *Attorney, Agent, or Firm*—Perry+Currier

(57) **ABSTRACT**

A shared light pipe is set forth for transmitting light generated by a message waiting LED in a mobile communication device, in one direction, and transmitting ambient or surrounding light, in an opposite direction, to a light sensor for controlling a display backlight of the device. The light pipe includes an elongated first portion having a first end for receiving and transmitting light and external surfaces for reflecting light there through via total internal reflection (TIR), a second portion coextensive with the first portion for outputting light received at the first end and reflected through the first portion, and a second branch coextensive with the first portion for receiving and transmitting light for output at the first end.

3 Claims, 1 Drawing Sheet



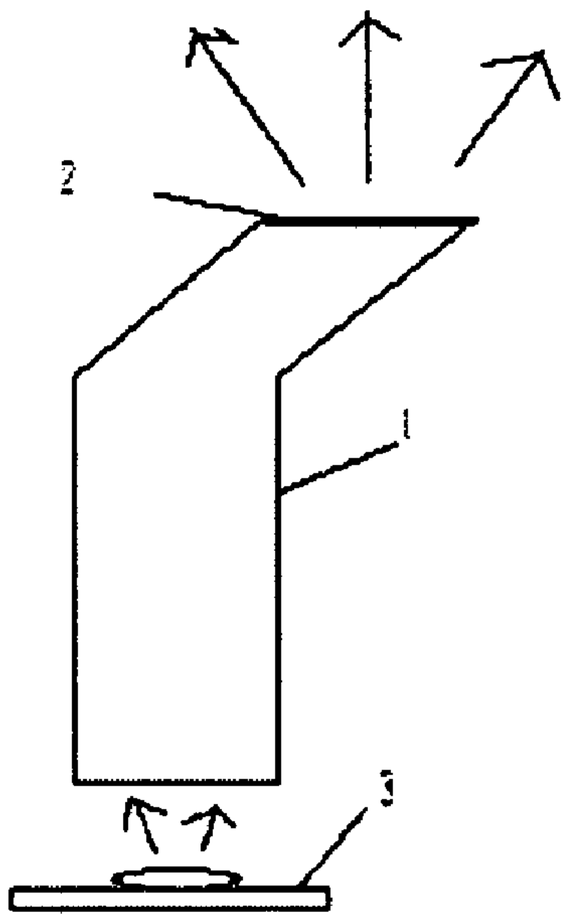


Fig. 1 (PRIOR ART)

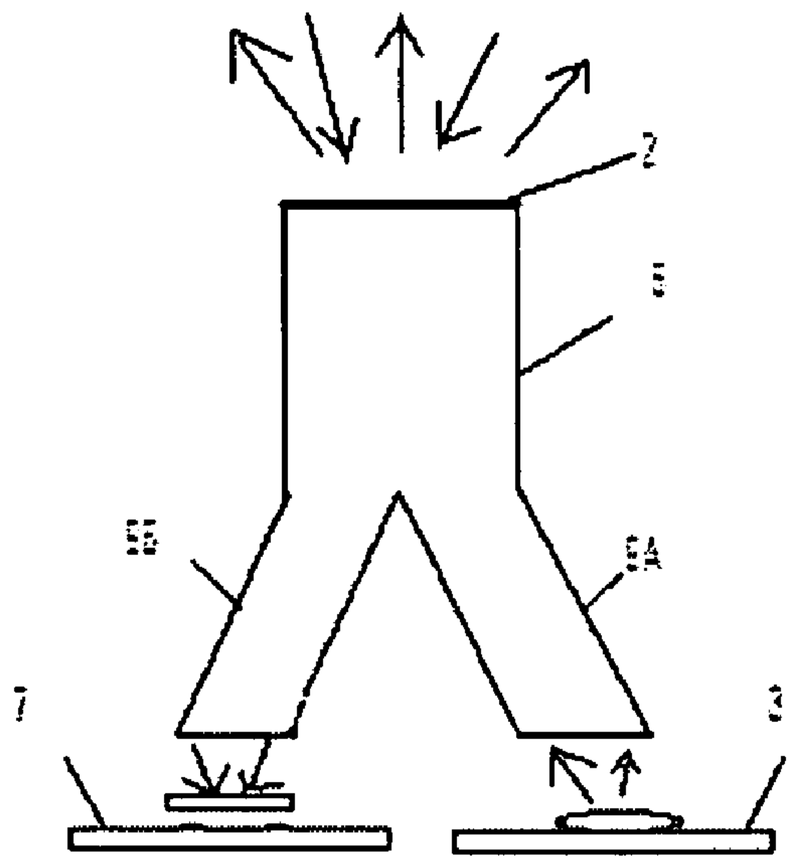


Fig. 2

SHARED LIGHT PIPE FOR A MESSAGE INDICATOR AND LIGHT SENSOR

FIELD

The following is directed in general to light pipes, and more particularly to a shared light pipe for message indicator and light sensor on a mobile communication device.

BACKGROUND

Mobile communication devices are becoming increasingly popular for business and personal use due to a relatively recent increase in number of services and features that the devices and mobile infrastructures support. Handheld mobile communication devices, sometimes referred to as mobile stations, are essentially portable computers having wireless capability, and come in various forms. These include Personal Digital Assistants (PDAs), cellular phones and smart phones. The user interface for such devices typically includes, a keyboard, a message waiting indicator to indicate received voice or email messages, and an LCD display.

The message waiting indicator typically comprises an LED mounted to a printed circuit board (PCB) within the device and a light pipe (sometimes referred to as a light guide) for transmitting light via Total Internal Reflection (TIR) from the LED to the surface of the device, so as o be visible to the user. The circuitry within the device causes the LED to flash upon receipt of a message, thereby notifying the user. The design and operation of such circuitry would be well known to a person of skill in the art, and does not form part of the present specification.

The LCD display typically includes a backlight control device to control variable brightness or to maintain the brightness of the display. The backlight control device includes a backlight lamp mounted on the back of an LCD to emit light, a light sensor for measuring intensity of the external or surrounding light, and an A/D converter for converting an electric signal, detected and generated by the light sensor, into a digital signal for controlling the backlight lamp.

It is highly desirable to minimize the size of such mobile communication devices for enhanced portability. However, incorporation of the light sensor consumes valuable real-estate on the surface of the device, and may detract from the appearance of the device.

SUMMARY

According to an aspect of this specification, a shared light pipe is provided for transmitting light generated by the internal message waiting LED, in one direction, and transmitting ambient or surrounding light, in an opposite direction, to an internal light sensor for controlling the backlight. Unlike the prior art, the shared light pipe as disclosed herein facilitates reduced size of the mobile communication device by minimizing real-estate on the surface of the device and on the PCB because the LED and light sensor can be placed very close together.

Additional aspects and advantages will be apparent to a person of ordinary skill in the art, residing in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of the preferred embodiment is set forth in detail below, with reference to the following drawings, in which:

FIG. **1** is schematic representation of a message waiting indicator for a mobile communication device according to the prior art; and

FIG. **2** is a schematic representation of a shared light pipe for message indicator and light sensor, according to the preferred embodiment.

DETAILED DESCRIPTION

With reference to FIG. **1**, a prior art message waiting indicator is shown comprising a light pipe **1** for transmitting light from a message LED **3** to a viewing surface **2** flush with the surface of a mobile communication device (not shown). The light pipe **1** generally comprises an elongated transparent or translucent member having reflection surfaces. As well known in the art, when a light ray is directed from the LED **3** into the light pipe and subtends a surface of the light pipe, if the incident angle formed by the light ray and the surface is less than a critical angle, the light is reflected back into the light pipe along a trajectory that defines a reflected angle equal to the incident angle and toward an opposite surface of the guide. Provided the light pipe **1** is designed properly and light rays directed into it are directed along suitable trajectories, the light pipe facilitates total internal reflection (TIR) of the light and hence passes all of the light to the opposite end **2** of the guide for viewing by a user. As discussed above, circuitry is provided within the device for causing the LED to flash upon receipt of a message, thereby notifying the user. The electronic circuitry is not shown, but would be well known to a person of skill in the art.

As discussed above, a light sensor may also be provided for controlling the display backlight. According to the prior art, such a light sensor is separate from the message indicator and is mounted directly to the surface of the mobile communication device.

According to the preferred embodiment of FIG. **2**, a shared light pipe **5** is provided for transmitting light from the message LED **3** to the surface **2**, as discussed above in connection with FIG. **1**. However, the shared light pipe **5** contains a pair of branches at a distal portion thereof, opposite the viewing surface, where one branch **9**A channels light from the LED **3**, and the other branch channels light to the internal light sensor **7**.

Preferably, the light pipe as disclosed herein, is molded from polycarbonate or acrylic, although it can alternatively be selected from bar stock.

In operation, the message light LED **3** is typically flashed according to the following pattern: 0.5 second on, 3 to 5 seconds off. The light sensor **7** is read by an internal processor (not shown) when the message LED **3** is off, thereby avoiding interference between generated and sensed light within the light pipe **5**.

Although not directly relevant to this disclosure, three readings are typically recorded from light sensor **7** in order to manage the backlighting function. A self test can also be performed by illuminating the LED **3** while taking a measurement at the light sensor **7**, thereby confirming the presence of both the LED **3** and sensor **7**. Additionally, if the LED **3** has multiple colours then the light sensor **7** can be used to confirm that as well (a test typically performed during the device manufacturing process).

In summary, the shared light pipe set forth herein effectively facilitates reduced size of the mobile communication device by minimizing real-estate on the surface of the device and on the PCB, and also minimizes the number of light pipes required for message light display and light sensing.

A person skilled in the art, having read this description of the preferred embodiment, may conceive of variations and alternative embodiments. For example, although the preferred embodiment refers to implementation within a mobile communication device (such as a PDA, cellular phone or smart phone), it is contemplated that the shared light pipe set forth herein may also be employed to advantage within desktop telephones, pagers or other communication devices.

All such variations and alternative embodiments are believed to be within the ambit of the claims appended hereto.

What is claimed is:

1. A method of operating a message light and an ambient light sensor optically connected via a shared light pipe, comprising:

flashing said message light according to a predetermined pattern; and

reading an output of said light sensor when said light is not being flashed, thereby avoiding interference between generated and sensed light within the shared light pipe.

2. The method of claim **1**, wherein said light is pattern is approximately 0.5 seconds on, followed by from approximately 3 to approximately 5 seconds off.

3. A method of confirming the presence of both a message light and an ambient light sensor optically connected via a shared light pipe, comprising:

flashing said message light; and

simultaneously reading an output of said light sensor.

* * * * *